भारतीय मानक
Indian Standard

IS 17427 : 2020

(*Superseding* IS 9340 : 1993, IS 11982 : 1987, IS 13546 : 1992, IS 11983 : 1987 *and* IS 13714 : 1993)

पैकेजिन्ग, भण्डारण और परिवहन के लिए वुडेन (टिम्बर) पैलेट — विशिष्टि

Wooden (Timber) Pallets for Packaging, Storage and Transportation — Specification

ICS 55.180.20

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Transport Packages, Packaging Codes, Freight Containers and Pallets Sectional Committee, TED 24

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by by the Transport Packages, Packaging Codes, Freight Containers and Pallets Sectional Committee had been approved by the Transport Engineering Division Council.

Wood is processed in the form of Timber into beams and planks. Any wood capable of yielding a minimum dimensional size can be termed as timber. Timber Pallets are commonly known as Wooden Pallets.

Wooden pallets are considered as an important ancillary packaging material for Industrial applications. These materials are used for storage, handling and shipment of cargo for domestic and export markets by means of different modes of transportation like Air, Road, Rail and Water ways. A Number of Indian as well as International Standards are in existence, which needs to be compiled in one Indian Standard for easy understanding by pallet manufacturers as well as user industries. Keeping in view of this objective, this draft Standard has been formulated in compliance to International Standards to meet the domestic and export market requirements.

This Indian Standard supersedes the following Indian Standards:

IS 9340	Specification for expendable timber pallets
IS 11982	Design rating and safe load for wooden pallets
IS 13546	Performance requirements of wooden pallets
IS 11983	Guidelines for marking of Pallets
IS 13714	Dunnage Pallets — Warehousing specification

While formulation of this standard, considerable assistance has been derived from the following ISO standards:

International Standard	*Title*
ISO 18333 : 2014	Pallets for material handling: Quality of new wooden component for pallets
ISO 18334 : 2010	Pallets for material handling: Quality of assembly of new wooden pallets
ISO 15629 : 2002	Quality of Fasteners for pallets.
ISO 12777-1 : 1994	Methods Of Test for Pallet Joints — Part 1: Determination of Bending Resistance of Pallet Nails, Other Dowel-Type Fasteners and Staples
ISO 12777-2 : 2000	Methods of Test for Pallet Joints — Part 2: Determination of Withdrawal and Head Pull-Through Resistance of Pallet Nails and Staples
ISO 12777-3 : 2002	Methods of Test for Pallet Joints — Part 3: Determination of Strength of Pallet Joints
ISO 6780 : 2003	Principal Dimensions and Tolerance in Intercontinental Material handling
ISO 18613 : 2014	Repair of pallets
ISO 12776 : 2008	Pallets – Slip sheets
ISO 8005 :1976	Classification of Unit Load
ISO 445 : 2013	Pallets for materials handling — Vocabulary

The composition of the Committee and the Panel responsible for the formulation of this standard is given at Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

WOODEN (TIMBER) PALLETS FOR PACKAGING, STORAGE AND TRANSPORTATION — SPECIFICATION

1 SCOPE

This standard for wooden pallets specifies Unit load, standard dimensions, Indian as well as imported environmentally sustainable species of timber, selection and optimum design criteria, safe working load, performance requirements, test methods, timber quality characteristics, fasteners dimensions, permissible defects, workmanship criteria, grading of pallets, handling guidelines, safety and maintenance, markings, repair , recycling and phytosanitary measures to provide protection against physical and mechanical hazards occurring during packaging, storage, handling and transportation.

It also includes dunnage pallets used in warehouses/ godowns for stacking of food grain bags for providing protection against floor moisture and biodegradation and for aeration of stored items on the pallets.

2 REFERENCES

The following standard contains provisions, which, through reference in this text, constitute provision of this standard. At the time of publication the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
399 : 1963	Classification of commercial timbers and their zonal distribution
401 : 2001	Preservation of timber — Code of Practice (*fourth revision*)
1141 : 1993	Seasoning of timber — Code of Practice (*second revision*)
3971 : 2019	Pallets for materials handling — Vocabulary (*third revision*)
4300 : 1989	Box pallets for through transit of goods — Specification (*first revision*)
5007 : 1996	Dimensions of pallet trucks
5325 : 1989	Box pallets for through transit of goods-methods (*first revision*)
5872 : 1990	Cold rolled steel stripes (Box strapping)
11215 : 1991	Method of determination of moisture content of timber and timber products.
11983 : 1987	Guidelines for marking of general purpose flat pallets for through transit of goods
13609 : 1992	Pallets — quality of timber- Guideline
13823 : 1993	Guidelines for palletization — General cargo

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

3.1 Pallets — The pallets are ancillary packaging materials which are defined as flat structure used as base for the unitization of goods in supply chain. The pallet as portable, horizontal, rigid, composite platform used as (a) based for assembling, storing, stacking, handling and transporting goods as unit load; often equipped with a super structure. The super structure is the assembly that is attached to supporting base of the pallet.

3.2 Non-expandable Pallets — The pallets which are strong enough to withstand repeated use.

3.3 Expandable Pallets — Pallets which are inexpensive and suitable for generally for one time use in transportation.

3.4 Dunnage Pallets — Dunnage pallets are mainly used for storage purpose in the warehouse/Godowns for stacking of packaged commodity goods in flexible bags made of either jute fabric or plastic woven sacks for providing the protection against floor moisture and biodegradation and forth aeration of stored items over the pallets.

3.5 Box Pallet — The box pallet is having an upper structure in frame form, attached above the pallet, which allows superimposition and consists of vertical side plates on at least three sides.

3.6 Decks — The top of the bottom flat or both surfaces.

3.7 Edge boards — The deck boards at either edge of the decks.

3.8 Stringers — The runners to which deckboards are fastened and which provide space for entry of forks or other handling devices.

3.9 Blocks — The square, rectangular or cylindrical pieces employed in place of springers, serving the same purpose in conjunction with stringer-boards.

3.10 Stringer Boards — The boards used for supporting the deckboards and connecting the blocks

3.11 Entry — Space provided for the insertion of forks or other handling devices.

3.12 Free Entry — The entry which provides no obstruction to the finger wheels (or load wheels) of a pallet trucks.

3.13 Restricted Entry — The entry where the finger wheel of pallet truck have to climb over boards for insertion.

3.14 Pay Load — Load carried by the pallet in use.

3.15 Nominal Load — Lowest safe load value for specified support conditions.

3.16 Maximum Working Load — Greatest payload that a pallet is permitted to carry in specific loading and support condition.

3.17 Ultimate Load — Load at which compression, displacement or deflection is no longer contained, resulting in the destruction of the specimen or breaking of one component, or when displacement, deformation or deflection becomes excessive.

3.18 Uniformly Distributed Bonded Load — Load spread across the full surface of the pallet deck, where the pattern of each single layer changes so that packages are interlocked.

3.19 Uniformly Distributed Unbonded Load — Load spread evenly across the full surface of the pallet top deck where the packages are not interlocked bound or connected.

3.20 Solid Load — Single, compact, rigid, homogeneous load supported by all the blocks or stringers of the pallet.

3.21 Concentrated Load — Load concentrated over an area of less than 50 percent of the pallet top deck.

3.22 Unit Load — The sum of pay load and weight of the pallet.

3.23 Stack Load — The total static load taken by the bottom pallet in a stack.

3.24 Rack Load — The total static load taken by pallet on rack system.

4 CLASSIFICATION OF PALLETS

4.1 Depending upon the applications, the pallets are broadly classified into four categories**:**

a) Non-expandable,

b) Expandable,

c) Box pallet, and

d) Dunnage pallet.

5 RATINGS

5.1 The nominal load rating *R* of a pallet shall be same as its unit load and shall be expressed as in multiples 250 kg.

5.2 A pallet shall be designed for minimum stack load of 4 times its rated load, that is, 4R for non-expandable pallet. However, for Expandable pallet, it should be minimum 2R.

6 QUALITY CHARACTERISTICS OF TIMBER FOR PALLETS

Based on the quality of the timber with permissible limit, construction and workmanship, the pallets are graded into two grades, namely, Grade 1 and Grade 2.The limitations of timber defects for Non-Expandable and Expandable pallets are given below.

6.1 Limitation of Timber Defects for Non-expandable Pallet

Sl No.	*Defects*	*Grade 1*	*Grade 2*
i)	Cross grains	Slope of grain not to exceed 1 in 8 of length in endboards, stringer boards, outside stringers and blocks; unlimited in Centre stringers and inside boards	Slope of grain not to exceed 1 in 6 of length in endboards, stringerboards, outside stringers and blocks; unlimited in centre stringers and inside boards
ii)	Knots (size, location and number)	a) Average diameter of any knot not to exceed 33 percent of the nominal width of the component	a) Average diameter of any knot not to exceed 23 percent of the nominal width of the piece
		b) No knots permitted on the outer edges of any edgeboards. No fastener to be driven into or through knots in edgeboards, but may he driven into sound knots in stringers. Stringerboards, or blocks	b) sound knots permissible in fastening area but no fastener to be driven through such knots on edgeboards, outside stringer or block unless compersated for by an adequate fastener. Fasteners may be driven into or through sound knots on inside deekboards and all stringerboards without a compensating fastener. Fastener may also be driven into sound knots or sound knots area in any part of a stringer or block
		c) Not more than two maximum size knots or their equivalent in any 200 mm length of a component. Additional such knots shall be separated by at less 100 mm	c) Not more than two maximum size knots or their equivalent in any 150 mm length of a component. Additional such knots shall be separated by at less 100 mm
		d) Loose or decayed knots shall not be permitted	d) Permitted, except on edgeboards, provided these shall be completely bored or cutout and tightly plugged with in cross-grained seasoned timber being of the same species of timber and properly glued, so that its grains run in the direction of the main piece
iii)	Checks	No limitation in number of length of checks in any piece, On edgeboards, checks are to be compensated for by adequate fastener if in direct line with the main fastener, checks in blocks that expose fastener shanks are not permitted	No limitation in quaintly or length of checks in any piece. Checks in blocks that expose screw shanks are not permitted
iv)	Splits and shakes (sizes, location and number)	Length of crack or grain separation shall be no longer than one half the width of the piece in all deckboards, stringerboards and blocks, and no longer than the width of the piece in stringers, splits running through full thickness of the piece (other than fastener splits) are not permitted on edgeboards, outside stringerboards, outside string, stringers or blocks, inside boards may contain splits if straddled by fastener. Shakes are not permitted in edgeboards stringerboards, outside stringers and outside blocks, but are permitted in not more than two inside boards if contained by fasteners	Length of crack or grain separation shall be no longer than one half the width of the piece in edgeboards and all blocks and no longer than the width of the piece in stringers, stringerboards and inside boards. Splits running through full thickness of the piece (other than fastener splits) in inside boards are allowed if straddled by fasteners. Splits in ends of outside stringers or block are permitted in edgeboards, stringerboards, outside stringers and outside blocks. But are permitted in no more than three inside boards if contained by fasteners

Sl No.	*Defects*	*Grade 1*	*Grade 2*
v)	Warp	Deviation on measured dimensions due to warp in any component of a pallet shall not exceed: a) Bow : 1.5 percent b) Crook : 1.5 percent c) Cup : 2.5 percent	Deviation on measured dimensions due to warp in any component of a pallet shall no exceed: a) Bow : 2 percent b) Crook : 2 percent c) Cup : 3 percent
vi)	Wane (size, location and number)	15 percent of width, 25 percent of thickness and unlimited length, on deckboards and stringerboards. 15 percent of width of fastening faces, 20 percent width of other faces and unlimited length, on stringers or blocks. No fastener to be driven into or through a wane, no wane permitted on exposed surface or edge (as opposed to ends). Not more than 25 percent of the total parts of a pallet may contain wane.	20 percent of width, 50 percent of thickness and unlimited length, on deckboards and stringerboards. 25 percent of width of fastening faces, 33 percent width of other faces and unlimited length, on stringers or blocks. No fastener to be driven into or through a wane, no wane permitted on exposed surface or edge (as opposed to ends). Not more than 25 percent of the total parts of a pallet may contain wane.
vii)	Decay	Not permitted	Not permitted
viii)	Stain	Permitted	Permitted
ix)	Moisture content	20 percent to be considered as average for all components at the time of fabrication and inspection, provided that in any one component it does	Maximum limit 25 percent for deckboards and unlimited for stringers and blocks

6.2 Limitation of Timber defects for Expandable pallets

The timber shall be seasoned and the moisture content shall not exceed 22 percent +/- 2 for grade A pallets and 30 percent ± 2 for the grade B pallets. The moisture content of timber shall be determined by oven dry method of electrical moisture meter as per IS 11215.

6.3 Workmanship for Expandable Timber Pallets

Defects	*Permitted Limitations*
Dimensions of components	Deviation tolerance of each piece from specified nominal (before surfacing) are given below: a) Length = 5 mm b) Width = 5 mm c) Thickness = 3 mm
Surfacing	Deckboards and stringerboards shall be surfaced two sides in width and one side in thickness with surfaced face to be exposed face surfacing tolerance 3 mm for thickness and 9 mm for width. Stringers and blocks shall be surfaced to two sides to uniform height surfacing tolerance 9 mm
Skip dressing	Shallow skips shall be permitted on blocks, shallow. Skips shall also be allowed on 50 percent of the other pieces subject to the area being limited to 20 percent of the area of the piece in which it occurs
Cross cutting	Beared ends not permitted. Deviation for square cut ends permitted on not more than 3 inside boards and 2 stringer or stringerboards provided no ends protrude more than 5 m beyond face of stringer, stringerboard or block or beyond outer edge of edgeboards
Deckboard spacing	Maximum toleration plus 6 mm in each case. No limitation on number of spaces
Parallelism of deviation deck boards	Within 50 percent in any one space, limited to no more than 5 such spaces per pallet

Defects	*Permitted Limitations*
Fastener splits	Hairline splits permitted up to 50 percent of the total fasteners applied on all pieces if on edgeboards, compensating fasteners are to be provided. Open splits permitted on ends provided they are compensated by additional fasteners
Protruding fastener heads and points	Not permitted
Dimensions of assembled pallet	Out of square deviation 12 mm (22 mm difference in diagonals). Overall length and width deviation = 10 mm

6.4 Workmanship for Non-Expandable Wooden Pallets

Sl No.	*Defects*	*Grade 1*	*Grade 2*
i)	Dimensions of components	Deviation tolerance of each piece from specified nominal (before surfacing) is given below: a) Length: ± 3 mm b) Width: ± 3 mm c) Thickness: ± 1.5 mm for deckboards And stringerboards and ± 1.5 mm for stringers and blocks.	Deviation tolerance of each piece from specified nominal (before surfacing) is given below: a) Length ± 4.5mm b) Width ± 4.5mm c) Thickness ± 1.5mm for deckboards And stringerboards and ± 3 mm for stringers and blocks
ii)	Surfacing	Deckboards and stringerboards shall be surfaced two sides in width (that is edges) and one side in thickness (that is surface) with surfaced face to be exposed face. Surfacing tolerance shall be ± 1.5 mm for thickness. Blocks shall be surfaced three sides to uniform height and width, surfacing tolerance of ± 6 mm	Deckboards and stringerboards shall be surfaced two sides in width and one side in thickness with surfaced face to be exposed face. Surfacing tolerance shall be ± 2 mm for thickness and ± 9 mm for width. Stringers and blocks shall be surfaced two sides to uniform height, with surfacing tolerance of ± 9 mm
iii)	Skip dressing	Shallow skips shall be permitted on blocks. Shallow skips shall also be allowed on 25 percent of other pieces subject to the area being limited to 10 percent of the area of the piece in which it occurs	Shallow skips shall be permitted on blocks; 30 percent of other piece may also contain shallow skips subject to the area being limited to 15 percent of the area of the piece in which it occurs
iv)	Cross cutting	Bearded ends not permitted. Deviation from square cut ends also not permitted except in cases where corners are to be rounded off	Bearded ends not permitted. Deviation from square cut ends permitted on not more than three inside boards and one stringer or stringerboard provided no ends protrude more than 3 mm beyond face of stringer, stringerboard or block or beyond outer edge of edgeboards
v)	Deckboard spacing	A tolerance of ± 6 mm in each space. No limitation for number of spaces	A tolerance of ± 6 mm in each space. No limitation for number of spaces
vi)	Parallelism of deckboards	Within 25 percent in any one space, limited to not more than two such spaces per pallet	Within 30 percent in any one space, limited to not more than three such spaces per pallet

7 SUSTAINABILITY OF TIMBER

In order to have the compliance to sustainability, wood is to be sourced either from domestic or overseas market. For imported timber, the manufacturer should have a sustainability certificate either from FSC (Forest Stewardship Council) or PEFC (The Programme for the Endorsement of Forest Certification). In case of timber sourced from Indian origin, the manufacturer should have a sustainability certificate either from Network for Certification and Conservation of Forests (NCCF) or FSC or any other govt. certified organization.

8 FASTENERS

a) Different kind of fasteners are used for construction of pallets for which IS 3971 may be referred.
b) Number of fasteners should be 3 on 145 mm width planks and 2 below 145 mm.
c) Wood screws used should be drilled and screwed in high density timber.
d) Screws are countersunk and should not protrude and flush with wood surface.
e) Fasteners should be driven keeping 35 to 50 mm apart and on center of stringer.
f) Length of fasteners should be minimum thrice the size of plank.
g) Clinching of nails are recommended for plank to plank joints.
h) Pallet is tested for nail, screw holding capacity before making pallets in bulk.
j) Fasteners should not be driven on knots.
k) Extra nail or screws should be applied if plank is cracked or with more knots. ISO 15629 to be followed for purpose of this standard.

8.1 Nail

Straight fastener, made from round or square stock, usually pointed and headed, designed to be impulse driven.

8.2 Plain Nail

Nail which is smooth and undeformed between head and point.

8.3 Clinch Nail

Nail specially designed to embed its point when driven and clinched.

8.4 Threaded Nail

Nail which a portion of the shank has formed so as to provide increased withdrawal resistance.

8.5 Helically Threaded Nail

Screw nail threaded nail on which the threaded portion has a medium lead angle and rolling expansion approximately equal to the depression.

8.6 Ring Nail

Annularly threaded nail, threaded nail on which the threaded portion has multiple ring-like threads rolled completely round the shank (*see* Fig. 1).

8.7 Interrupted Thread Nail

Threaded nail on which the threaded portion has a non-threaded zone between two threaded areas, to allow for collating by wire or plastics strip (*see* Fig. 2).

8.8 Barbed Nail

Nail on which the formed portion has repetitive indentations and ridges which might or might not be symmetrical.

8.9 Twisted Nail

Nail made from square-section wire with helical flutes for the full length of the shank (*see* Fig. 3).

8.10 Collated Nail

Nail in a loose reel held temporarily together by connecting wires or strips in order to feed automatic pneumatic or electric nailing tools.

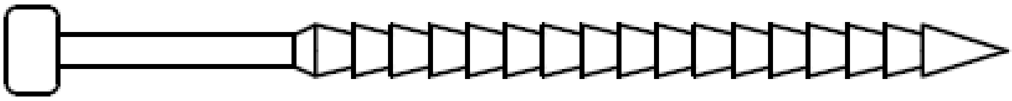


FIG. 1 RING NAIL

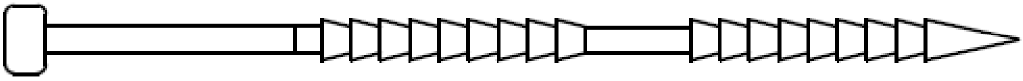


FIG. 2 INTERRUPTED THREAD NAIL

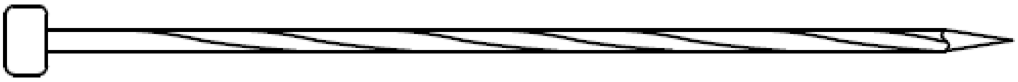


FIG. 3 TWISTED NAIL

8.11 Fluted Nail

Round wire nail with thread-crests parallel to the nail shank.

8.12 Staple

Round or square wire fastener, U-shaped with two legs, usually of the same length, connected by its crown, and with the legs usually pointed (*see* Fig. 4).

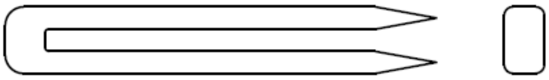


FIG. 4 STAPLE

8.13 Stitch

Staple-type of fastener which is formed at the point of assembly from wire coil stock.

8.14 Screw

Straight, slender, pointed and headed fastener with a thread along a portion of the shank and with a slot or other indentation in the head to facilitate turning for insertion (*see* Fig. 5).

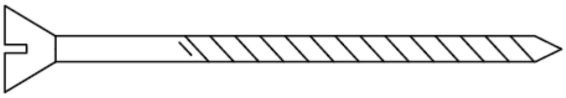


FIG. 5 SCREW

8.15 Bolt

Threaded fastener with a coarse thread and with a square or hexagonal head (*see* Fig. 6).

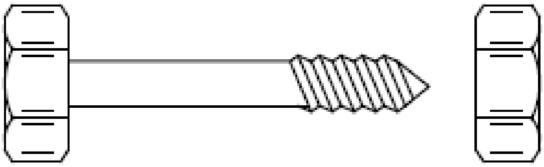


FIG. 6 BOLT

8.16 Coach Bolt

Bolt with square or other shape under the head to prevent turning when located (*see* Fig. 7).

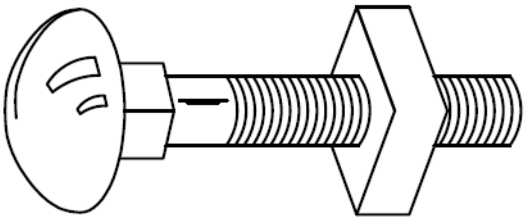


FIG. 7 COACH BOLT

8.17 Pallet Rivet

Hollow tube rivet with large head which can be pressure-peened to make a bell-shaped end (*see* Fig. 8).

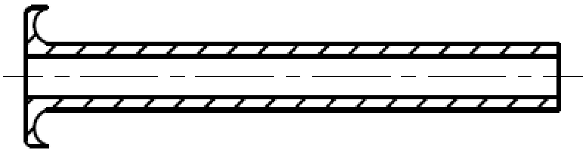


FIG. 8 PALLET RIVET

8.18 Corrugated Fastener

Sheet-metal-type fastener with corrugations of approximately 5 mm pitch and one sharpened edge (*see* Fig. 9).

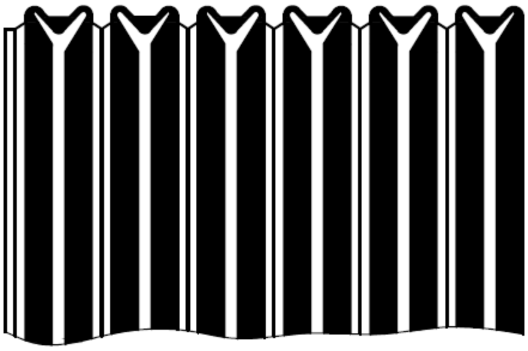


FIG. 9 CORRUGATED FASTENER

8.19 Metal Connector Plate

Light-gauge flat metal plate with protruding teeth or barbs which are pressed into wood to connect two components or repair a broken pallet component.

8.20 Snap Fitting

Connection of interlocking clips formed by pressing two components together.

8.21 Bolts, Wood Screws and Lag Bolts

When bolts, wood screws or lag bolts are used at least two per corner connections and at least one at all other connections are recommended. It is recommended that bolts be retightened at the time the connected components reach equilibrium moisture content during the use of the pallet.

9 PALLET COMPONENTS AND FEATURES

The pallet components and features recommended for the construction of different designs of wooden pallets are as specified under **6** of IS 3971.

9.1 Fastening Schedules

For nails and staples, the minimum recommended number of driven fasteners per pallet component is given in Table 3.

Table 3 Minimum number of driven fasteners

(*Clause* 9.1)

Element	Width	Minimum Number of Fasteners per Connection
Deckbord	< 130	2
	313 to 175	3
	176 to 200	4
Comer block	-	3
Interior block	-	2

9.2 Fastener Placement

Fasteners should be placed in such a way as to minimize splitting of the connected components. Fasteners should be no closer than 25 mm is recommended. The distance between the nail and the end of the deck board should not be less than 25 mm.

For stringer-type pallets, the distance the fasteners and the periphery of the deck board should be not less than five times the nail shank and the distance between fasteners should be not less than 10 times the diameter of the nail shank.

Staple crowns should not be parallel to the grain of the deck components. A combination of the various fastener types in a single connection should be avoided if they do not interact effectively, that is contribute simultaneously to the stiffness and strength, or both, of the connection. For example, bolts in oversized holes and driven fasteners represent a poor combination and cannot be expected to work in unison. They should not be placed in the same connection or different connections of an assembly.

9.3 Clinching Points of Driven Fasteners

Clinched fasteners should be at least 6 mm longer than the sum of the thicknesses of the components being fastened and driven in such a manner as prevent bucking of the fastener under the crown or head.

9.4 Fasteners-caused Splits

Open splits with visible fasteners shanks or legs should be limited. Not more than one open split with a visible fastener shank or leg per connection should occur and not more than one-third of the components per pallet should contain open splits with visible fastener shank or legs at the completion of manufacture.

9.4 Protruding Fasteners

Nail heads, staple crowns, bolt heads, nuts, and screw heads should be flush or below deck surfaces. Countersinking fastener heads and protruding fastener points should not significantly affect pallet performance. There should be no protruding fastener points on the exposed face of outside stringers or blocks or in lead deck board areas. Provided they do not significantly affect pallet performance, a maximum of 2 percent of protruding fasteners (rounded to the nearest whole number) may occur on unexposed surfaces. Fastener points should not protrude when using non-clinched fasteners to attach deck boards to stringer boards in block class pallets.

10 RECOMMENDED DIMENSIONS OF PALLETS

Depending upon the usage, the following standard dimensions of wooden pallets either Non-Expandable or Expandable should be used by the Indian companies:

Sl No.	*Dimensions* (mm) *L* × *W* × *H*
i)	1 000 × 1 200 × 145
ii)	1 100 × 1 100 × 145
iii)	800 × 1 200 × 145
iv)	1 300 × 1 100 × 150
v)	1 200 × 1 200 × 150
vi)	1 000 × 1 000 × 140
vii)	800 × 800 × 140
viii)	1 200 × 1 800 × 200
ix)	1 500 × 600 × 130 (For storage only).
x)	1 500 × 900 × 130 (For storage only).
xi)	1 200 × 1 200 × 140

In addition, any other dimensions can be finalized between the buyer and the seller for domestic and export market

10.1 Dimensions of Wings

In a wing pallet, the minimum width of wing shall be 75 mm for 1 200 × 1 800 mm pallet; and 65 mm for other size of pallets.

10.2 Height of the Pallet and Height of Loaded Pallet

For non-expandable pallets height of pallet ranges from 80 mm to 200 mm maximum.

For block type pallets height of pallet is sum of thickness of,

a) top planks,
b) stringer plank,
c) base plank, and
d) clearance for fork entry.

For stringer type pallet height of pallet is sum of thickness of top planks plus thickness of base plank plus clearance for fork entry.

Thickness of planks is decided by engineering calculation for safe load and height of the stringer or blocks are dependent on clearance required.

Height of expandable pallet can be reduce to minimum 80 mm to get more space for cargo in shipping container.

In case of storage pallets for food grain height of pallet shall be minimum 145 mm. for stringers plus 35 mm for planks.

In case of perimeter base or heavy duty pallets height of pallet 200 mm maximum.

10.3 Height of Pallet with Cargo Loading

Height of loaded pallet should not exceed larger dimension out of length or width of pallet.

For loading on racks height is restricted to slot height less lifting clearance but not exceeding larger dimensions of length or width of pallet.

Height of cargo loaded pallet can be increased if cargo is secured by pallatizing using PVC cover, shrink wrap and strapping.

11 CONSTRUCTION AND DESIGN OF PALLETS

11. 1 The following designs of wooden pallets are recommended for packaging, storage and transportation of goods.

11.1.1 *Single-deck Pallet (Recommended for Dunnage)*

Flat pallet with only one deck (*see* Fig. 10).

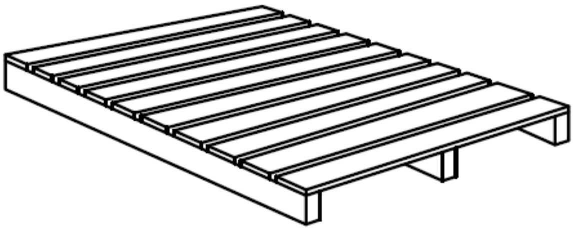


Fig. 10 Single Deck Pallet

11.1.2 *Double-deck Pallet*

Flat pallet with a top deck (*see* **6.1**) and a bottom deck (*see* **6.2**) (*see* Fig. 11).

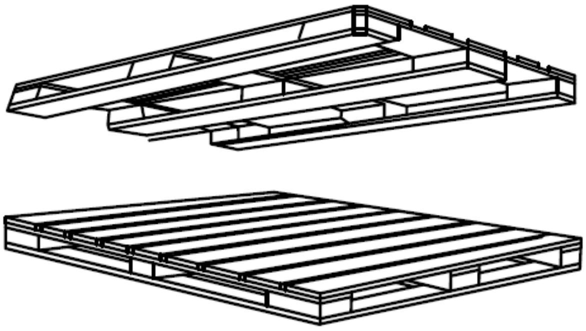


Fig. 11 Double Deck Pallet

11.1.3 *Reversible Pallet*

Double-deck flat pallet with similar top and bottom decks, either of which can take the same load (*see* Fig. 12).

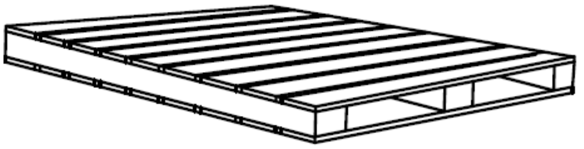


Fig. 12 Reversible Pallet

11.1.4 *Non-reversible Pallet*

Double-deck flat pallet with only one load-carrying surface (*see* Fig. 13).

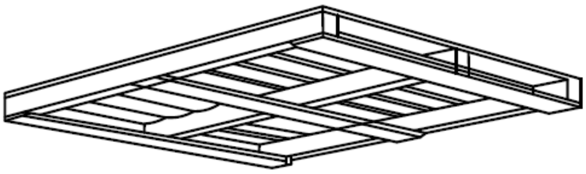


Fig. 13 Non-Reversible Pallet

11.1.5 *Two-way Pallet*

Pallet permitting the entry of the fork arms of fork-lift trucks or pallet trucks from two opposite directions only (*see* Fig. 14).

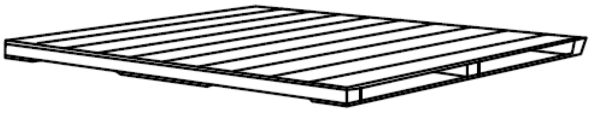


Fig. 14 Two Way Pallet

11.1.6 *Four-way Pallet*

Pallet permitting the entry of the fork arms of fork-lift trucks and pallet trucks from all four directions (*see* Fig. 15).

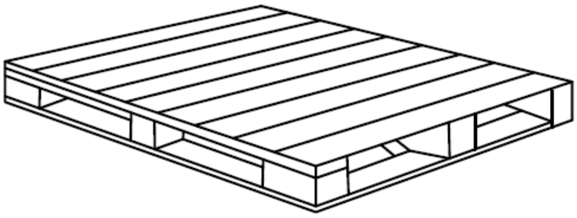


Fig. 15 Four Way Pallet

11.1.7 *Overlap pallet*

Pallet with stringer boards in both top and bottom decks (*see* Fig. 16).

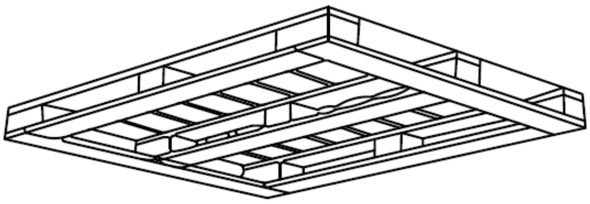


Fig. 16 Overlap Pallet

11.1.8 *Wing*

Portion of the deck or decks which projects beyond the stringers or blocks, designed for lifting by crane attachment (*see* Fig. 17).

11.1.9 *Notched Stringer Pallet*

Pallet with stringers in each of which there are two notches (*see* Fig. 18).

11.1.10 *Perimeter-base Pallet*

Window pallet which has the outer bottom deckboards arranged as a complete frame with one or two centre boards (*see* Fig. 19).

12 MOISTURE CONTENT IN PALLETS

Moisture content in timber used for pallet plays a significant role to maintain the strength, durability, machinability.

Moisture in timber used for pallet is around 30 to 60 percent while in green timber form. While timber dries in natural condition due to sun heat and in the presence of humidity of atmosphere which causes stress in timber resulting into many defects viz. cracks, shakes, warp, bend, twist, etc. and thus, reduces mechanical strength of timber. Moreover, the presence of moisture leads to insects and fungal attack on timber which drastically hamper the quality of timber.

Due to this fact, the timber needs to be subjected to proper seasoning as per IS 1141 method in order to maintain the uniform moisture content of timber below 20 percent. In case of wet timber, the timber should be treated by following the standards method as per IS 401.

13 TEST PARAMETERS

For general applications, the following tests shall be complied with:

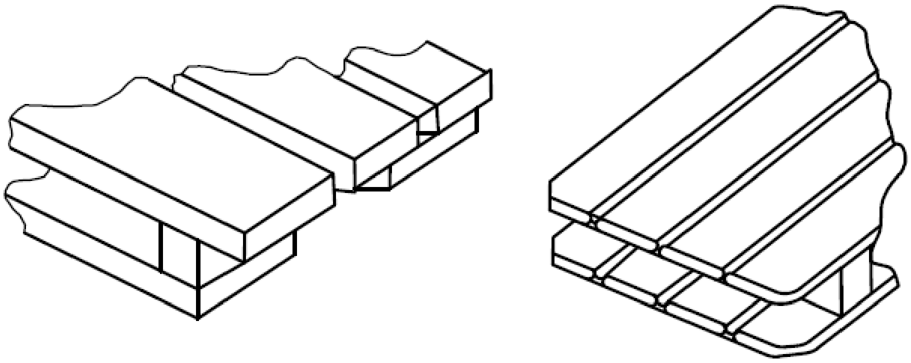


FIG. 17 WINGS

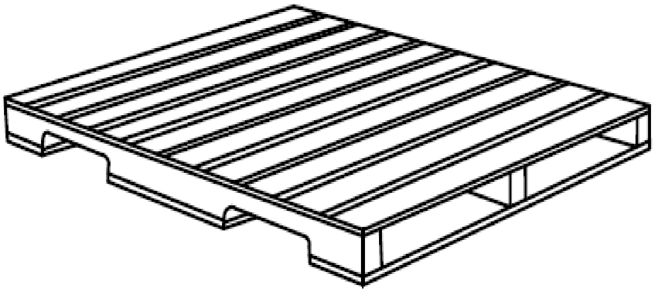


FIG. 18 NOTCHED STRINGER PALLET

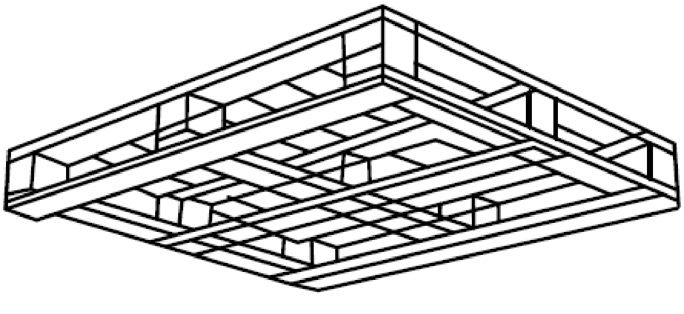


FIG. 19 PERIMETER-BASE PALLET

Test No.	Test Measurement	Handling Activity or Purpose of the Test	Performance Requirement	Test Method
Nominal Load Test				
1.	Stacking test (Static load)	Stacking	The change in height as deflection of pallet at specific point or corner block at top deck with 2R or 4R nominal load should be identical for every successive readings of 5 min interval up to the maximum period of 60 min.	**8.1** of IS 6219 : 1989
2.	Bending test Stiffness Flexural strength	Racking	a) The deflection of pallet with 2R or 4R nominal load at top deck (50 mm from outer edge) to the unsupported centre should not exceed 7 mm. b) Every successive readings of 5 min interval up to the maximum period of 60 min should be identical.	**8.2** of IS 6219 : 1989
3.	Bottom deck test Stiffness and Flexural strength of the bottom deck boards between support points.	Racking	The change in height as deflection of pallet at specific parallel points at bottom deck with 2R or 4R nominal load should be identical for every successive readings of 5 min interval up to the maximum period of 60 min.	**8.3** of IS 6219 : 1989
4.	Inclined impact plane test (Shear test) Shear resistance between top and bottom decks.	Distortion resistance	The deformation changes of pallet at the shear point of impact should be recorded.	**9.1.1** of IS 6219 : 1989
5.	Incline plane test (Leading edge impact test) shunting resistance of the top leading edge deck-board	Resistance to fork arm	a) The deflection changes of pallet at the point of impact between 100 mm to 250 mm from the shank should be same in every time. b) The penetration depth and general damage at points of impact shall also be recorded.	**9.1.2** of IS 6219 : 1989
6.	Incline plane test (Block impact test) Resistance of pallet blocks to eccentric impacts at the corners	Resistance to fork tip	The displacement of blocks or stringers after each impact together with indentation depth should be recorded	**9.1.3** of IS 6219 : 1989

Test No.	Test Measurement	Handling Activity or Purpose of the Test	Performance Requirement	Test Method
Nominal Load Test				
7.	Corner drop test	Resistance to Impact	The deformation of the pallet after 3 drops should not be more than 40 mm from each corner	**9.2** of IS 6219 : 1989
8.	Compression test	Any activity that compresses blocks or stringers including stacking	Deformation and deflection in height of pallet with respect to ultimate load should be recorded.	Annex A
9.	Fork Lifting test	Lifting with forklift and pallet trucks.	Record the ultimate load until reaching to an excessive deflection or deformation	Annex B

NOTE — For storage purpose, the tests listed at Sl No. 5, 6 and 9 are not recommended.

14 REGULATION OF WOOD PACKAGING MATERIAL

The wooden pallets should be subjected to any one of the following Techniques to avoid growth of micro-organisms during storage and transportation and to meet the requirement International Phytosanitary measures (ISPM: 15).

14.1 Heat Treatment Using Conventional System

When using conventional heat chamber technology, the fundamental requirement is to achieve a minimum temperature of 56°C for a minimum duration of 30 min throughout the entire profile of the wood (including its core. This temperature could be measured by inserting temperature sensor in the core of the wood.

Alternatively, when using kiln-drying heat chambers or other heat treatment chambers, treatment schedules may be based on a series of heat treatments during which the core temperature of the wood at various locations inside the heat has been measured and correlated with chamber air temperature, taking into account the moisture content of the wood and other substantial parameters (such as species and thickness of the wood, air flow rate and humidity). The test series must demonstrate that a minimum temperature of 56°C is maintained for a minimum duration of 30 min throughout the entire profile of the wood.

Treatment schedules should be specified or approved by NPPO.

14.2 Methyl Bromide Treatment

NPPOs are encouraged to promote the use of alternative treatments approved in this standard. Use of methyl bromide should take into account the CPM recommendation on the replacement or reduction of the use of methyl bromide as a phytosanitary measure (CPM 2008).

Wood packaging material containing a piece of wood exceeding 20 cm in cross-section at its smallest dimension must not be treated with methyl bromide.

The fumigation of wood packaging material with methyl bromide must be in accordance with a schedule specified or approved by NPPO that achieves the minimum concentration- time product (CT) over 24 h. This CT must be achieved throughout the profile of the wood, including its core, although the concentration would be measured in the ambient temperature. The minimum temperature of the wood and its surrounding atmosphere must not be less than 10°C and minimum exposure time must not be less than 24 h. Monitoring of gas concentrations must be carried out at a minimum at 2, 4 and 24 h from the beginning of the treatment. In the case of longer exposure times and weaker concentrations, additional measurement of the gas concentration should be recorded at the end of fumigation.

14.3 Heat Treatment Using Di-electric Heating

Where di-electric heating is used (for example, microwave) wood packaging material composed of wood not exceeding 20 cm^4 when measured across the smallest dimension of the piece or the stack must be heated to achieve a minimum temperature of 60°C for 1 continuous minute throughout the entire profile of the wood (including its surface). The prescribed temperature must be reached within 30 minutes from the start of the treatment.

Treatment schedules should be specified or approved by NPPO.

15 MARKING

The pallet shall be legibly and indelibly marked with the following information:

a) Manufacturers name or recognizable trademark/brand/Logo.
b) Year and month of manufacture
c) Marking for heat treatment (HT) or chemical treatment to meet the compliance of International phytosanitary measures (ISPM 15)
d) Any other information as specified by purchaser

16 GUIDELINES FOR MARKING OF PALLETS

16.1 There shall be 7 ratings (R) with appropriate codes as given below for through transit pallets:

a) 250 kg : A
b) 500 kg : B
c) 750 kg : C
d) 1 000 kg : D
e) 1 250 kg : E
f) 1 500 kg : F
g) 1 750 kg : G

16.2 Pallets shall be marked A to G according to their rating.

16.3 No pallet shall be marked with safe working load in kg, however, assembled unit loads may be marked with gross and tare weight as required for safe handling.

16.4 Safe working load (SWL) shall vary according to load severity and the allocation of safe working Load values is the responsibility of the unit load supervisor assembler.

Example:

A 1 000 kg rated pallet (validated by tests) shall be marked BIS/D. It may, ‘at various stages of its life when being used for differing unit loads, be carrying more or less than 1 000 kg.

ANNEX A

(*Clause* 13)

COMPRESSION TESTS FOR BLOCKS OR STRINGERS

A-1 PURPOSE

The purpose of this test is to determine the compression strength and stiffness of the blocks, stringers or columns of the pallet. Blocks or stringers supporting superstructures or heavy rigid loads shall be tested.

A-2 PROCEDURE:

Place the pallet in a normal position on a flat, hard, rigid and horizontal surface. Place a rigid load applicator of dimensions (300 ± 5) mm x (300 ± 5) mm × (25 ± 5) mm over a block or a portion of a stringer (*see* Fig. 20).

Place the test load centrally onto the load applicator as shown by the arrows in Fig. 20. When the blocks or stringers differ in design, each design shall be tested.

Alternatively, the test may be carried out on several identical corners, blocks or springer.

3 MEASUREMENT

3.1 Determination of Strength of Blocks or Stringers

Apply the load until breakage occurs in one of the blocks or stringers of the pallet or upon reaching an excessive deflection or deformation. Record the ultimate load.

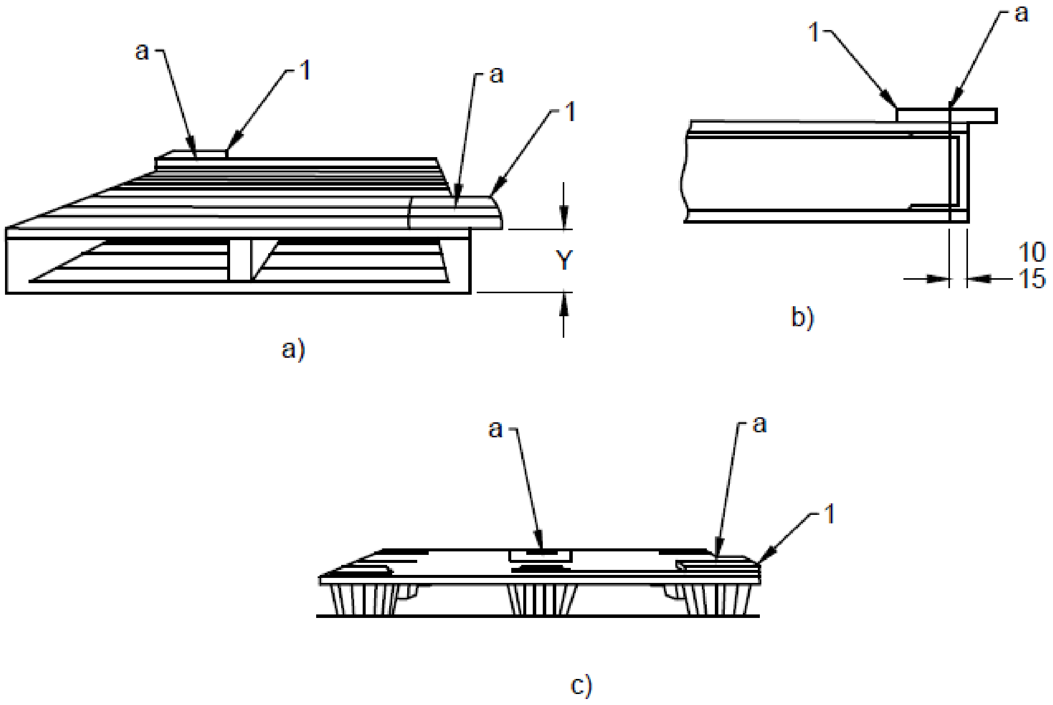
3.2 Determination of Stiffness of Blocks or Stringers

Apply a datum load of percent of the ultimate load determined in test 13 (1)

The deflection ‘y’ shall be measured,

After positioning of datum load.
Immediately after the full test load is applied.
At the end of the full test load period.

After the relaxation period.



Key

1 load applicator
y deflection
a Test load

FIG. 20 CORNER COMPRESSION TEST

ANNEX B

(*Clause* 13)

FORK LIFTING TEST

B-1 PURPOSE:

The limiting condition of use for non-rackable and non-stackable single or double –deck pallets is the bending of the pallet on fork arm supports under the top deck of the pallet.

B-2 PROCEDURE:

The fork lifting test is shown schematically in Fig 21. The test method permits simulation of the forklifting condition of use in each direction of pallet length and width. The supports shall conform to Figure Q. The support distances may be either 570 mm or 690 mm (see Fig. 21, Foot note). The shorter of the two distances that occur during pallet use used in the test. For pallets greater than 1219 mm in length or width, footnote of a Figure Q may be adjusted according to the dimensions of the pallet.

B-3 MEASUREMENT

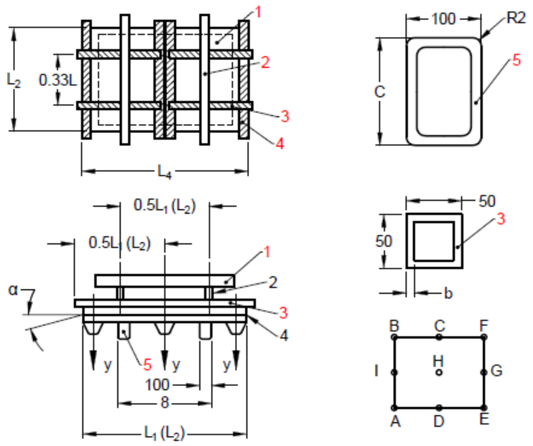
B-3.1 Test (a) Determination of Bending Strength

Apply the test load until breakage occurs in one of the components of the pallet or until reaching an excessive deflection or deformation. Record the ultimate load.

B-3.2 Test (b) Determination of Bending Stiffness

Apply a datum load of (1.5 ± 0.5) percent of the ultimate load determined in **B-3.1** [test (1)]. Depending on the support location, the deflection, 'y' shall be measured simultaneously at the middle of the two ends or sides and at the corners (maximum value of 'y' at points A, B, C, D, E, F, G, H and I depending on the direction of supports).

After positioning of datum load;
Immediately after full test load is applied;
At the end of the full load period; and
After the relaxation period.



All dimension in millimetres

Key

1 test load
2 load applicator
3 steel load bar, 50 mm × 50 mm × $L \left[\geq \frac{L1}{2}\right]$
4 steel load bar, 50 mm × 50 mm × $L \left[\geq \frac{L1}{2}\right]$
5 support
A to I deflection measuring points
y deflection
a The distance between the supports 570 mm or 690 mm.
b Steel load bar thickness ≥ 2 mm.
c Support length ≤ 200 mm.
d Bend angle of pallet deck while testing.

FIG. 21 FORKLIFTING TEST

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Transport Packages, Packaging Codes, Freight Containers and Pallets Sectional Committee, TED 24

Organization	*Representative(s)*
In Personal Capacity Mumbai	Dr N. C. Saha (***Chairman***)
Association of Multi Modal Transport Operators of India, Mumbai	Shri Arun Kumar
Bay Container Terminal Pvt Ltd, Mumbai	Capt Somesh Batra Shri Dauji Singh (*Alternate*)
Central Warehousing Corp Ltd, New Delhi	Shri Ajay Khera
DEEKAY Pine Board Pvt Ltd, Gandhidham	Shri Ashwini Kedia Shri Naval Kedia (*Alternate*)
Federation of Corrugated Box Manufacturers of India, Mumbai	Shri K. P. Singh Shri Rajkamal Jindal (*Alternate*)
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